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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|-----------------------------|------------------|
| 10/803,614 | 03/18/2004 | Thorsten Rohwer | 8540G-000136 (GP-302246) | 5878 |
| 27572 | 7590 | 04/14/2006 | EXAMINER | |
| HARNESS, DICKEY & PIERCE, P.L.C. P.O. BOX 828 BLOOMFIELD HILLS, MI 48303 | | | ECHELMEYER, ALIX ELIZABETH | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 1745 | |

DATE MAILED: 04/14/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|---------------------------|---------------------|--|
| Office Action Summary | Application No. | Applicant(s) | |
| | 10/803,614 | ROHWER ET AL. | |
| | Examiner | Art Unit | |
| | Alix Elizabeth Echelmeyer | 1745 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☒ Claim(s) 14 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>3-18-04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Information Disclosure Statement

1. The Information Disclosure Statement has been considered by the examiner.

Claim Objections

2. Claim 14 is objected to because of the following informalities: it recites a "water flow channel to *delivery* water..." Examiner suggests that the flow channel is to *deliver* water. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-3, 10, and 15-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson et al. (US Patent Number 6,150,049) in view of Ouvry et al. (US Patent Number 6,444,347).

Nelson et al. teach a hydration system for a polymer electrolyte membrane (PEM) fuel cell having fluid flow plates with fluid openings into flow channels (abstract; column 2 lines 48-60). Nelson et al. also teach the layers of a fluid flow plate, the anode, the membrane electrode assembly (MEA), the cathode, and another fluid flow plate. In

this invention, the gas diffusion layer of the MEA is made of carbon cloth or carbon paper (Figure 3; column 5 lines 26-65).

Nelson et al. fail to teach the gas diffusion medium between the plate and the MEA having a hydrophobic layer adjacent the plate and a hydrophilic layer adjacent the MEA.

Ouvry et al. teach an electrode made of a hydrophilic carbon fiber cloth having coatings on either side. On the outside, adjacent the fluid flow plate, is a microporous polytetrafluoroethylene (PTFE) layer that creates a layer having hydrophobic characteristics on the carbon cloth. On the opposite side is a layer carrying the catalyst for the reaction of the fuel cell within which this gas diffusion media is contained (Figure 1; column 4 lines 62-67; column 5 lines 1-6).

The use of the gas diffusion membrane of Ouvry et al. in a PEM would allow greater control of the hydration system because the layers having either hydrophobic or hydrophilic characteristics are arranged in a manner that controls how water flows throughout the membrane, not just whether and where it flows into the membrane as the fuel cell assembly of Nelson et al. teaches.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use the gas diffusion layer of Ouvry et al. in the fuel cell of Nelson et al. in order to provide better control of the hydration of the fuel cell.

4. Claims 4-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson et al. and Ouvry et al. in view of Imahashi et al. (US Patent Number 5,350,643).

The teachings of Nelson et al. and Ouvry et al. as discussed above are incorporated herein.

Nelson et al. in combination with Ouvry et al. teach a PEM having a gas diffusion assembly with a hydrophobic layer adjacent the fluid flow plate and a hydrophilic layer adjacent that hydrophobic layer.

Nelson et al. with Ouvry et al. fail to teach variability of hydrophobicity and hydrophilicity in the cross-plane and in-plane directions of the hydrophobic and hydrophilic layers.

Imahashi et al. teach water-repellency concentration gradients along layers of hydrophobicity and hydrophilicity. Imahashi et al further teach that the performance of fuel cells can be markedly improved by this gradient of water-repellent concentration (column 7 lines 37-67; column 8 lines 1-8).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have vary the ability of a layer to repel or attract water in the layers of Nelson et al. in view of Ouvry et al. as taught by Imahashi et al. because Imahashi et al. teaches that such a gradient can improve the performance of the fuel cell.

5. Claims 11-14 and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson et al. and Ouvry et al. in view of Gascoyne et al. (US Pre-Grant Publication 2003/0031909).

The teachings of Nelson et al. in view of Ouvry et al. as discussed above are incorporated herein.

Nelson et al. and Ouvry et al. teach fluid flow plates that provide reactants and water to the MEA of the fuel cell.

Nelson et al. with Ouvry et al. fail to teach the use of a capillary element in the MEA to allow water to pass through the hydrophobic layer into the inner parts of the gas diffusion layer and MEA.

Gascoyne et al. teach an MEA having channels and/or capillaries that extend to the outer edge of the sheet in order to supply additional water to the system ([0001], [0015]). Gascoyne et al. further teach that these channels or capillaries have benefits including improved tolerance to cell reversal and enhanced performance of the cell at higher temperatures. The ability to humidify the membrane externally leads to increased water content of the membrane, which improves tolerance to drying. ([0045]).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to include the capillaries of Gascoyne et al. in the MEA of Ouvry et al. and Nelson et al. because of the many benefits they can provide, such as the ability to humidify the membrane externally, which improves the tolerance of the cell to drying.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alix Elizabeth Echelmeyer whose telephone number is 571-272-1101. The examiner can normally be reached on Mon-Fri 7-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


PATRICK JOSEPH RYAN
SUPERVISORY PATENT EXAMINER

Alix Elizabeth Echelmeyer
Examiner
Art Unit 1745

aee